

6.2 Bubble Chamber Temperature Ramp up/down Procedure

Written Procedure

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This procedure covers the process of changing the temperature of the bubble chamber and compensating for the ensuing thermal expansion or contraction. Obviously there is plenty of room to screw up here as well. Hence this is a written procedure. We cover three circumstances. First, the cool-down of a non-pressurized chamber such as is the case prior to CF₃I distillation. Second and third are the warm-up and cool-down of the pressurized chamber with a full charge of CF₃I.

Non-Pressurized chamber cool-down:

- 1) Your initial condition is a chamber under vacuum with a slight positive pressure in the glycol in the pressure vessel. The fast piston should be near its upper stop. In principle, one could instruct the hydraulic cart to regulate at, say, 5 psi and proceed with the cool down. In that case the piston would continuously adjust to absorb the thermal contraction. I am not however confident of the behavior of this system at low pressure, so we'll do this one "by hand."
- 2) Lower the chiller set point to 0°C and start watching the vessel.
- 3) As the glycol contracts, you may see the vessel position dropping and/or a loss of the small positive pressure.
- 4) Compensate the vessel position/pressure with small downward adjustments of the hydraulic piston.
- 5) Keep doing this until it is cold. Shifts may be required.

Warm-Up of the fully charged bubble chamber:

- 1) Here the initial condition is a chamber under pressure with the hydraulic cart in a "safe" condition. This means that the cart is "compressed" but is regulating the pressure at a value just above that generated by the pneumatic pressure. In this mode the pressure regulation will compensate the thermal expansion.
- 2) Now you can slowly ramp up the temperature. This shouldn't require much effort other than to watch and make sure the cart is doing its job.
- 3) At some point, the thermal expansion of the CF₃I within the inner vessel will exceed the allowable extension of the bellows. At this point, it will be necessary to bleed off additional water to maintain the proper vessel height.

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Cool-Down of the fully charged bubble chamber:

- 1) Here the initial condition is a chamber under pressure with the hydraulic cart in a “safe” condition. This means that the cart is “compressed” but is regulating the pressure at a value just above that generated by the pneumatic pressure. In this mode the pressure regulation will compensate the thermal contraction.
- 2) Now you can slowly ramp down the temperature. This shouldn’t require much effort other than to watch and make sure the cart is doing its job.
- 3) At some point, the thermal contraction of the CF_3I within the inner vessel will cause the bellows to approach its stop. At (or before...) this point, it would be wise to lower the compression pressure so that any pressure differential across the jar and bellows would be minimized if we actually sit down onto the stop.